SECURITY CLASSIFICATION OF THIS PAGE AD-A172 092 (2)

REPORT DOCUMENTATION PAGE

DTIC ELECTED SEP 19 1986 S D

1a. REPORT SECURITY CLASSIFICATION: unclass/	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release, distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S): AFOSR-TR-86-0797
6a. NAME OF PERFORMING ORGANIZATION: SRI INTERNATIONAL	6b. OFFICE SYMBOL (If applicable)
7a. NAME OF MONITORING ORGANIZATION: AFOSR	
6c. ADDRESS (City, State and ZIP Code): 333 Ravenswood Avenue, Menlo Park CA 94025	7b. ADDRESS (City, State and ZIP Code): Same as 8c
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: AFOSR/NE	8b. OFFICE SYMBOL (If applicable)
9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: F49620-85-C-0103	
8c. ADDRESS (City, State and ZIP Code): Bolling AFB DC 20332-6448	10. SOURCE OF FUNDING NOS.

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
61102F	0053 ~~DARPA~~	96	

11. TITLE (Include Security Classification): SEMICONDUCTOR ENGINEERING FOR HIGH-SPEED DEVICES

12. PERSONAL AUTHOR(S): A. SHER, S. KRISHNAMURTHY, A.B. CHEN

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
1st QUARTERLY	FROM ~~01Jul85~~ TO ~~31Sep85~~		3

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB. GR.	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This rpt contains a summary of significant accomplishments and progress during the reporting period. Programs to calculate pure crystal and alloy band structures have beencompleted and now include all important components, e.g. long-range interactions, spin-orbit interactions, and molecular CPA. The parameters that properly reproduce the band structures of light III-V compounds--GaP, InP, AlAs, GaAs, InAs, AlSb, GaSb, and InSb--have been selected and their band structures calculated. We are now prepared to run the band structures of the 14 three-component pseudo-binary alloys of these materials. These claculations were undertaken to test our procedures on a comparatively simple, well-characterized alloy system. The results agree with experiment and give satisfactory explanation of several features that were previously thought to be anomalous. It is clear that the general trends of the data and theory agree.

DTIC FILE COPY

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS ☐	

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
Kevin J Malloy, Capt, USAF	202 767 4932	AFOSR/NE

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

86 9 18 157

SECURITY CLASSIFICATION OF THIS PAGE

AD-A172 092

SRI International

SEMICONDUCTOR ENGINEERING FOR HIGH-SPEED DEVICES

Quarterly R&D Status Report 1

Covering the Period 1 June to 15 September 1985

18 September 1985

By: A. Sher (Principal Investigator, 415-859-4466)
S. Krishnamurthy, and A.-B. Chen
Physical Electronics Laboratory

Prepared for:

Air Force Office of Scientific Research
Bolling Air Force Base, D.C. 20332-6448

Advanced Research Projects Agency (DOD)
1400 Wilson Boulevard
Arlington, Virginia 22209

Attn: Captain Kevin Malloy, Program Manager
(202-767-4984)

SRI Project 8725
ARPA Order 5396, Program Code 5D10
Contract F49620-85-C-0103
Effective Date: 1 June 1985
Contract Expiration Date: 31 May 1988
Contract Dollars: $611,296

SRI International®
333 Ravenswood Ave. • Menlo Park, CA 94025
415 326-6200 • TWX: 910-373-2046 • Telex: 334-486

I DESCRIPTION OF PROGRESS

This report contains a summary of significant accomplishments and progress during the reporting period, 1 June to 15 September 1985.

Programs to calculate pure crystal and alloy band structures have been completed and now include all important components, e.g. long-range interactions, spin-orbit interactions, and molecular CPA.

The parameters that properly reproduce the band structures of light III-V compounds--GaP, InP, AlAs, GaAs, InAs, AlSb, GaSb, and InSb--have been selected and their band structures calculated. We are now prepared to run the band structures of the 14 three-component pseudo-binary alloys of these materials.

Two papers were published in this period and one other submitted on the $Si_{1-x}Ge_x$ alloy:

- Krishnamurthy, S., A. Sher, and A.-B. Chen, 1985: "Generalized Brooks' Formula and the Electron Mobility in Si_xGe_{1-x} Alloys," Appl. Phys. Lett., 47, p. 160.
- Krishnamurthy, S., A. Sher, and A.-B. Chen, 1985: "Binding Energy and Spectral Width of Si2p Core Excitons in Si_xGe_{1-x} Alloys," Phys. Rev. Lett., 55, p. 320.
- Krishnamurthy, S., A. Sher, and A.-B. Chen, "Band Structures of Si_xGe_{1-x} Alloys" (submitted to Phys. Rev. B).

These calculations were undertaken to test our procedures on a comparatively simple, well-characterized alloy system. The results agree with experiment and give satisfactory explanation of several features that were previously thought to be anomalous.

W.E. Spicer's group at Stanford is measuring the angle-resolved photo-emission spectra of $Hg_{1-x}Cd_xTe$ alloys, and we have calculated the energy and momentum dependent spectral density functions to compare with their data. Once again, this gives us a chance to compare the theory to a well-controlled experiment, although HgCdTe, a narrow gap semiconductor, lies outside the scope of materials we are to study under this contract. It is already clear that the general trends of the data and theory agree, but a detailed comparison must still be done. The result will be reported in the next period.

We have started a literature search on various aspects of this program, e.g. hot electron theory and ballistic device analysis. One paper we have uncovered on hot electron theory looks particularly helpful* In this paper, a technique is developed within the context of the many body Schrodinger equation to separate the center of mass and relative to the center of mass motions of electrons propagating through a medium in the presence of a strong electric field. The coupled center of mass and scattered motion equations are then solved in a kind of random phase approximation (RPA). RPA is a method of ignoring fast quantum coherence-induced transients and solving what amounts to a stationary state problem. Thus, RPA must be modified to treat the fast transient effects encountered in a ballistic transport device, but this approach should be more reasonable than those currently used, which depend on assumed drifted Maxwellian distributions.

II EQUIPMENT PURCHASED OR CONSTRUCTED

None.

III TRIPS, MEETINGS, PAPERS, AND VISITS

Papers published and submitted were listed in Section I. No other information to report in this area.

IV PROBLEMS OR AREAS OF CONCERN

None.

V DEVIATION FROM PLANNED EFFORT

None.

---

*Lei, X.L. and C.S. Ting, 1985: "Green's-Function Approach to Nonlinear Electronic Transport for an Electron-Impurity-Phonon System in a Strong Electric Field," Phys Rev. B32, p. 1112.

VI FISCAL STATUS

As of this report, all work is progressing as scheduled. Contract dollars are $611,296. To date, $61,000 has been spent with $80,000 available through 31 December 1985. Estimated date of completion is as scheduled.